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Original Research Article

Clinical study of lower respiratory tract infections in children attending a tertiary care hospital

Venkata Krishna Munagala[1], Ramisetty M. Uma Mahesh[1]*, Jithendra Kandati[2], Munilakshmi Ponugoti[2]

[1]Department of Pediatrics, [2]Department of Microbiology, Narayana Medical College, Nellore, Andhra Pradesh, India

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***Correspondence:**
Dr. Ramisetty M. Uma Mahesh,
E-mail: mum14@gmail.com

ABSTRACT

Background: WHO estimated burden of respiratory tract infections in 2010, estimates four and half million deaths due to respiratory tract infections among children every year. In India, 1.2 million deaths have been reported among children due to RTI among 5.9 million deaths globally. Lower respiratory tract infections are most common causes of death than upper respiratory tract infections. Pneumonia and Bronchiolitis are most common types of LRTI in children. Pneumonia accounts for most of the deaths in children < 5 years of age. The present study was undertaken with an objective to know the various types of lower respiratory tract infections in children less than 12 years of age. The study also aims to know the various bacterial agents causing respiratory tract infections with their antibiotic susceptibility.
Methods: Hospital based, prospective cross-sectional study was conducted for a period of one year and 375 children were enrolled. Demographic, clinical history and examination was done and signs and symptoms noted. All necessary investigations were performed and followed regularly for management and outcome.
Results: Incidence of LRTI in the study was 9.76% with male preponderance (65.33%) and most common among children in 1-4 years age group. Ratio of males to females was 1.9:1. 73.6% of cases were in low socio-economic group, 35.2% were found with PEM-I grade and 18.13% had no immunization coverage. Cough and breathlessness were the major symptoms and respiratory distress and clubbing were major signs in the study. Bronchopneumonia was the commonest cause (38.7%) followed by bronchiolitis and Allergic bronchitis. 18.45 of cases had anemia and Leucocytosis was also present. Pulmonary infiltration was the major finding in the X-ray of chest. *Streptococcus pneumoniae* and *Klebsiella pneumoniae* were the common bacterial pathogens isolated.
Conclusions: To conclude, our study clearly highlighted the various types of clinical presentations, risk factors and different types of LRTI in children <12 years of age. Understanding a clear knowledge of the etiology and bacterial pathogens clearly provides guidance for the physician in management and clinical outcome.

Keywords: Allergic bronchitis, Broncho pneumonia, *Klebsiella pneumoniae*, LRTI, *Streptococcus pneumoniae*

INTRODUCTION

Acute respiratory tract infections are one of the leading causes of morbidity and mortality among children in both developed and developing countries. WHO estimated burden of respiratory tract infections in 2010, estimates four and half million deaths due to respiratory tract infections among children every year. In India, 1.2 million deaths have been reported among children due to RTI among 5.9 million deaths globally.[1] India has the

highest number of deaths among children < 5 years of age and most of them are due to respiratory tract infections. These infections are broadly divided into upper and lower respiratory tract infections. Lower respiratory tract infections are most common causes of death than upper respiratory tract infections. Pneumonia and Bronchiolitis are most common types of LRTI in children. Pneumonia accounts for most of the deaths in children 5 years of age.[2]

LRTI is not a single disease entity, but a group of infections with different etiology, risk factors, pathogenesis, clinical presentations and outcomes. The etiology, epidemiology and symptomatology vary with age, gender, risk factors, season, place and type of population. These LRTI are affected by socio demographic and soci-cultural factors which are modifiable by simple interventional measures.[3] Risk factors which are modifiable were lack of breast feeding, overcrowding, under nutrition, delayed weaning, and prelacteal feeding. Other associated conditions like PEM, infectious diseases, and secondary bacterial infections make the child more vulnerable for mortality and morbidity. The etiological agents of LRTI are viral, bacterial in origin or both combined together.[4]

The present study was undertaken with an objective to know the various types of lower respiratory tract infections in children less than 12 years of age. The study also aims to know the various bacterial agents causing respiratory tract infections with their antibiotic susceptibility.

METHODS

A prospective, cross sectional study was conducted at Narayana medical college and general hospital by Department of Pediatrics for a period of one year from March 2015 to February 2016. The study was approved by the institutional ethical committee and the protocol was followed as per the ethical guidelines. The patient's demographic data, clinical history, family history, immunization coverage, house hold contacts history, type of delivery and a thorough clinical examination was done and signs and symptoms were recorded in a separate predesigned questionnaire sheet. The study parameters were clearly explained to the parents/Guardians and written consent was obtained.

Inclusion criteria

- Children who were admitted with the symptoms of fever, cough, breathlessness, wheeze, stridor, hoarseness of voice etc. were the subject of the study.
- Age group from 1 month to 12 years.

Exclusion criteria

- Children below 1 month and above 12 years.
- Children with congenital heart and lung diseases.

A thorough clinical examination with more emphasis on respiratory system was carried out and other systems were examined for any infective foci. Follow up of the child was done regularly with constant vigilance for development of new signs and symptoms. On admission regular laboratory investigations (Hb%, TC, DC, ESR, X-ray chest, ECG) were done and special investigations like lumbar puncture was done when necessary. Investigations pertaining to respiratory system include throat swab, sputum staining (Gram's, AFB) and culture and sensitivity were done if necessary. Invasive procedures like gastric aspirations (In cases, who couldn't produce sputum for examination), pleural tapping and per cutaneous lung aspiration were done in cases of pleural effusion, empyema. The aspirated fluids analysis was done for cells, AFB and culture and sensitivity.

Mantoux test was done in suspected cases of tuberculosis. All the cases were followed regularly on admission and investigations were repeated during the follow up for observation of improvement or detioration

Bacterial etiological agents were identified by regular standard biochemical test and antibiotic susceptibility was noted for the isolates.

Statistical analysis

All the data was entered in a Microsoft excel spread sheet and checked for corrections. All the variables were entered and analyzed by Graph pad prism software.

RESULTS

In the present study, a total of 3840 admissions were done during the study period in pediatric ward, out of which 375 cases were admitted with lower respiratory infections. The incidence of LRTI in the study period was 9.76%. All the cases of LRTI were monitored and followed up regularly. There a clear-cut male preponderance with 245 males (65.33%) and 130 females (34.67%). Male to female ratio in the study was 1.9:1. The most commonage group in the study was 1-4 years (46.67%) followed in order by 5-8 years (25.6%). Females were more predominant in the age group of 1-4 years whereas males in the rest of the age groups. 73.6% of the cases were placed in low socioeconomic status as per B G Prasad's socio-economic classification and female children were more in middle income group (23.08%). Protein energy malnutrition (PEM) was graded as per classification of Indian academy of Pediatricians, and 9.87% were normal and majorities (35.20%) of the cases were in PEM- I followed in order by II, III and IV (22.13%, 17.87%, and 14.93%). Increased incidence of PEM-II and IV is probably due to disease itself, low intake of food due to fever, anorexia, and false belief not to feed child during the fever or whenever child is not active. 18.13% of cases in the study gave no history of

vaccination which is quite appealing and all are from low socio-economic status and illiterate. BCG and OPV coverage was done in 80.27% of cases while DPT and MMR was 76.53% and 76.80%. However, most of the illiterates were not able to differentiate from BCG, DPT and MMR vaccines. Data was obtained from the vaccination chart provided to the mother at the time of immunization (Table 1).

Table 1: Age wise distribution of demographic characters of cases.

Demographic character	Male		Female		Total	
	No	%	No	%	No	%
Age group (in years)						
1 -12 months	24	9.80	7	5.38	31	8.27
1 - 4 years	106	43.27	69	53.08	175	46.67
5-8 years	64	26.12	32	24.62	96	25.60
9-12 years	51	20.82	22	16.92	73	19.47
Total	245 (65.33)		130 (34.67)		375	100.00
Socioeconomic status						
Low income	188	76.73	88	67.69	276	73.6
Middle income	31	12.65	30	23.08	61	16.3
Upper class	26	10.61	12	9.23	38	10.1
Protien energy malnutition						
Normal	27	11.02	10	7.69	37	9.87
Pem-I	75	30.61	57	43.85	132	35.20
Pem-II	58	23.67	25	19.23	83	22.13
Pem-III	45	18.37	22	16.92	67	17.87
Pem-IV	40	16.33	16	12.31	56	14.93
Immunization staus						
No vaccination	43	17.55	25	19.23	68	18.13
BCG	211	86.12	90	69.23	301	80.27
DPT	222	90.61	67	51.54	287	76.53
OPV	228	93.06	73	56.15	301	80.27
MMR	202	82.45	86	66.15	288	76.80

* socio economic status as per B G Prasads classification

Majority of the cases presented to the OP or emergency with cough (98.1%) and Breathlessness (95.2%). Fever was present in 91.2% of the cases followed in the order by in drawing of inter costal space observed in 76.8% of cases.

Pain in the chest was complained by 60.8% and history of recurrent attacks was said by 49.6% of cases. Failure to thrive and refusal of feed was observed in 26.1% and 71.5% of cases (Table 2).

Table 2: Incidence of signs among cases in the study.

Signs	No	%
Clubbing	344	91.7
Pallor	312	83.2
vitamin deficiency (Aand B)	264	70.4
Respiratory distress	356	94.9
Lymphadenopathy	264	70.4
hepatomegaly	26	6.9
Spleenomegaly	38	10.1
Meningeal irritation signs	12	3.2

In the study, 94.9% of cases had respiratory distress followed by clubbing in 91.7% of cases. Pallor was noticed in 83.2 5 of cases and severe anemia was noticed in 5.9% of cases with Hb% <5gms/ml.

Table 3: Symptoms of LRTI in cases of the study.

Symptoms	No	%
Fever	342	91.2
Cough	368	98.1
Breathlessness	357	95.2
Indrawing of intercostal space	288	76.8
Running nose	122	32.5
History of repeated attacks of respiratory infection	186	49.6
Vomiting/diarrhea	126	33.6
Pyoderma	38	10.1
Pain in the chest	228	60.8
Failure to thrive	98	26.1
Not taking feed	268	71.5

Signs of vitamin A and B deficiency were noted in 70.4% of cases and Lymphadenopathy (Cervical) was observed in 70.4% of cases and none of them were matted and no

discharging sinuses were noticed. Less commonly observed signs were hepatomegaly (6.9%); spleenomegaly (10.1%) and signs of meningeal irritation were observed in 3.2% of cases (Table 3). Broncho pneumonia was the most common clinical entity associated LRTI (38.7%) and most commonly seen in age group of 1-4 years (90 cases). Other conditions were Bronchioloitis, (8.5%) and Allergic bronchitis (9.6%). Bronchiectasis was observed in 6.4% of cases and whooping cough with aspiration pneumonia in 5.6% of cases. Consolidation of lung (21 cases), pneumonic consolidation in 12 cases, Miliary tuberculosis in 12 cases and Bronchial asthma was observed in 16 cases of our study (Table 4).

5.9% of cases had severe anemia (<5gms) and 12.5% were moderately anemic. Leucocytosis was observed in 13.1% of cases with Leukocyte count >15000 cells/mm^3. Mantoux test was performed in 126 cases and 82 cases (62.1%) were positive and started on Anti tubercular treatment. Unilateral pulmonary infiltration was the commonest Chest X-ray finding (33.6%) followed in order by bilateral pulmonary infiltration (22.9%) in present study.

Table 4: Type of LRTI and age wise distribution (years).

Type of LRTI	0 - 1 years	1-4 years	5-8 years	9-12 years	Total	%
Bronchiolitis	7	6	16	3	32	8.5
Allergic bronchitis		24	6	6	36	9.6
Bronchopneumonia (Post measles+TB)	16	90	29	10	145	38.7
Whooping cough with aspiration pneumonia	1	7	9	4	21	5.6
Pleural effusion (TB etc)		4	6	8	18	4.8
Empyema thoracis		3	4	3	10	2.7
Hydro/pyo/pneumothorax		3	5	2	10	2.7
Pneumonic consolidation of lung	2	6	2	2	12	3.2
Bronchiectasis	3	12	4	5	24	6.4
Collapse/consolidation of TB etiology		6	3	12	21	5.6
Acute laryngotracheo bronchitis		6	4	8	18	4.8
Miliary tuberculosis		4	3	5	12	3.2
Bronchial asthma	2	4	5	5	16	4.3
Total	31	175	96	73	375	

Table 5: Investigation results of cases in the study.

Investigation	No.	%
Hb%		
Upto 5 gms	22	5.9
5 – 10 gms	47	12.5
> 10 gms	306	81.6
Total Leukocyte count		
4500 – 11000 cells	238	63.5
11000 – 15000 cells	88	23.5
15,000 – 25,000 cells	37	9.9
>25,00 cells/mm^3	12	3.2
Mantoux Test (no= 126)		
Positive	82	65.1
Negative	42	33.3
X-ray Findings		
Unilateral pulmonary infiltration	126	33.6
Bilateral pulmonary infiltration	86	22.9
Pleural effusion / empyema	18	4.8
Hrilar / paratracheal lymphadenopathy	46	12.3
Miliary mottling	14	3.7
Hydro/ Pyo/ Pneumothorax	10	2.7

Bronchiectasis was observed in 6.4% of cases, hilar/paratracheal lymphadenopathy in 12.3% of cases, Pleural effusion in 4.8% of cases and miliary mottling and pneumothorax in 3.7% and 2.7% of cases in our study (Table 5).

Sputum culture revealed *Streptococcus pneumoniae* as the most common isolate among gram positive organisms and Klebsiella pneumoniae in gram negative organisms. Other pathogens isolated were *Staphylococcus aureus*, *Hemophilus influenza*, *Escherichia coli*, and *Pseudomonas aeruginosa*. *Streptococcus pneumoniae* was sensitive to penicillin, whereas gram negative isolates exhibited multi drug resistance. Most of the gram-negative isolates were sensitive to Ceftriaxone, cefixime, piperacillin+tazobactum and Imipenems in our study.

DISCUSSION

Lower respiratory tract infections still continue to be a significant cause of morbidity and mortality in developing countries. In present study, the incidence of RTI was 9.8% which is significant, when compared to many other causes of admissions in the hospital. However, the incidence of LRTI in present study was significantly lower when compared with the findings of Paramesh et al who reported the incidence of 12.85% in

his study.[5] The reason can be explained by not including children <1 month and >12 years of age in the study. Incidence of RTI in an area is dependable upon multiple factors like season of the study, climatic factors of the region and cultural and traditional factors. The most common age group in the study was 1-4 years with male preponderance which is on par with findings of Yellanthoor RB et al who reported similar pattern of prevalence in his study and male to female ratio.[6]

LRTI was most common in children belonging to low socioeconomic status, which is also added by many risk factors like overcrowding, malnutrition, absence of immunization etc which are more commonly observed in low socio-economic group. The incidence of LRTI in our study among low socioeconomic group was 73.65% which is similar to findings of Kabra SK, Broor S et al.[7]

PEM-I was observed in 35.20% with maximum in female children than males, in 1-4 years age group. This was a different finding in our study, which is contrary to observations of Sonego M et al who reported PEM-III as the most common risk factor in development of LRTI.[8] Lack of immunization coverage, leads to high risk for development of LRTI, which is stated in various studies globally.

Cough and breathlessness were the most common clinical symptoms in our study. The same findings were presented in the study of Rashad, Mohamed M. et al who also reported that fever was also constantly associated with LRTI.[9] Some of the studies stated, that indrawing of intercostal space is associated with severity of the disease, 76.8% of cases in the study had intercostal space indrawing. Pain in the chest and History of repeated attacks are also significant findings in our study and also reported by Mahajan V et al in his study.[10] Respiratory distress was a significant and predominant sign observed in our study followed by clubbing which was noticed in 91% of cases of study. Similar findings were reported by Ranganathan SC et al in his study and further noticed Anemia also a significant sign in children of LRTI.[11] Lymphadenopathy was also observed in 70% of cases in our study and associated with pneumonia, Tuberculosis, and other infections of the lung parenchyma. Lymphadenopathy was not a significant factor in our study.

Bronchopneumonia was the commonest LRTI in our study with an incidence of 38.7% followed by Bronchioloitis (8.5%). Most of the studies also reported the same cause as the most common etiology of LRTI and significant cause of mortality in children aged <5 years. It was most common in children of 1-4 years age group in our study.[12] Other etiologies observed in our study were Allergic bronchitis, Bronchiectasis, pleural effusion, Bronchial asthma and miliary tuberculosis. However, the incidence of disease is variable and is multifactorial dependent.

Anemia was considered as a significant observation in our study and 18.4% of cases were anemic. Anemia is considered both as a risk factor and associated condition in cases of LRTI. Malnutrition is one cause of development of anemia in cases of LRTI.[13] Leucocytosis was a significant feature observed in cases of LRTI. Mantoux test was positive in 65.1% of cases but its association with LRTI was not statistically significant. Pulmonary infiltration was the commonest X-ray feature observed and found statistically significant.

Streptococcus pneumoniae was the commonest gram-positive pathogen as mentione din many studies and *Klebsiella pneumoniae* was the commonest gram-negative pathogen in our study. These findings are on par with findings of Baranwal Ak et al and Sanjeev Joshi et al.[14,15]

CONCLUSION

To conclude, our study clearly highlighted the various types of clinical presentations, risk factors and different types of LRTI in children <12 years of age. Understanding a clear knowledge of the etiology and bacterial pathogens clearly provides guidance for the physician in management and clinical outcome.

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REFERENCES

1. WHO. World health organization pneumonia. 2012. Available from http://www.who.int/medicacentre/factsheets/en/.
2. Francis BV, Abhilash TG. Study of acute respiratory tract infections in children. Internat J Sci Res. 2016;5(9):1791-2.
3. Alter SJ, Vidwan NK, Sobande PO, Omoloja A, Bennett JS. Common childhood bacterial infections. Curr Probl Pediatr Adolesc Health Care. 2011;41(10):256-83.
4. Erling V, Jalil F, Hanson LA, Zaman S. The impact of climate on the prevalence of respiratory tract infection in early childhood in Lahore, Pakistan. J Pub Health. 1999;21:331-9.
5. Paramesh H. Epidemiology of asthma in India. Indian J Pediatr. 2002;69(4):309-12.
6. Yellanthoor RB, Shah VK. Prevalence of malnutrition among under-five year old children with acute lower respiratory tract infection hospitalized at Udupi District Hospital. Arch Pediatr Infect Dis. 2014;2(2):203-6.
7. Kabra SK, Broor S, Lodha R, Maitreyi RS, Ghosh M, Pandey RM, Puranik M. Can we identify acute severe viral lower respiratorytract infection clinically? Indian Pediatr. 2004;41(3):245-9.

8. Sonego M, Pellegrin MC, Becker G, Lazzerini M. Risk factors for mortality from acute lower respiratory infections (ALRI) in children under five years of age in low and middle-income countries: a systematic review and meta-analysis of observational studies. PloS one. 2015;10(1):e0116380.
9. Rashad MM, Fayed SM, El-Hag AM. Iron-deficiency anemia as a risk factor for pneumonia in children. Benha Medic J. 2015;32(2):96.
10. Mahajan V, Tiwari M, Arya A, Tiwari A, Chawla D, Saini SS. Clinical predictors of hospital admission in acute lower respiratory tract infection in 2 months to 2 year old children. Respirol. 2016;21(2):350-6.
11. Ranganathan SC, Sonappa S. Pneumonia and other respiratory infections. Pediatr Clin North Am. 2009;56(1):135-56.
12. Mansharamani NG, Koziel H. Chronic lung sepsis: lung abscess, bronchiectasis, and empyema. Curr Opin Pulmonary Med. 2003;9(3):181-5.
13. Ramakrishnan K, Harish PS. Hemoglobin level as a risk factor for lower respiratory tract infections. Indian J Pediatr. 2006;73(10):881-3.
14. Baranwal AK, Singh M, Marwaha RK, Kumar L. Empyema thoracis: a 10-year comparative review of hospitalised children from south Asia. Arch Dis Childhood. 2003;88(11):1009-14.
15. Joshi S, Lakhani JK. Clinical study and outcome of empyema thoracis in children in a district level hospital. Karnataka Pediatr J. 2004;18(1)2004:17.

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